

OUR ASTRONOMICAL COLUMN.

ORIGIN OF THE LUNAR FORMATIONS.—The experiments by which Scrope attempted to reproduce the characteristic features of the moon's surface have been repeated with slight modifications by M. Stanislas Meunier, and the results which he has obtained are certainly very suggestive, if, indeed, they do not furnish the key to the origin of the various formations which the moon presents to us. (*Comptes rendus*, January 28.) Plaster is mixed with water in which a little glue has been dissolved to prevent too rapid setting, and the mixture is heated in a frying-pan over a gas-burner until ebullition commences; the gas is suddenly turned off at an opportune moment, and the mass is left to cool undisturbed. Experimenting in this way, and by varying the consistency of the paste, M. Meunier has obtained many features besides the intermingling circular cavities produced by Scrope. The central peaks which are so frequently noticed in lunar craters are reproduced perfectly, being formed at exactly the same time as the circular borders, and even resembling their lunar prototypes in being generally somewhat lower than the edges of the craters. Further, the artificial craters tend to form in groups of two or three, or even more, and sometimes one ring will envelope several; some parts may be covered with cavities, with or without central peaks, and relatively large smooth areas at once recall the lunar "seas." If the experiment be carried on until nearly the whole of the water is evaporated, fissures also make their appearance.

By covering the paste with fine grey sand at the moment it begins to boil, the results are said to be still more striking, and better adapted for photography.

M. Meunier expresses the opinion that the moon has failed to pass through all the planetary stages, in consequence of the original relative scarcity of fluids, and he believes this conception to be confirmed to some extent by another modification of the experiment, in which the paste is covered with a rather thick layer of sand, representing the rocks forming the earth's epidermis; the "volcanic" manifestations then change character, and more nearly approach terrestrial types.

γ CASSIOPEIÆ.—This star has always possessed a special interest to spectroscopic observers since the discovery of bright lines in its spectrum by Secchi. Continued observations seemed to suggest a periodicity in the visibility of the bright lines, but this question can now be attacked more completely by the photographic method. Fifty-three photographs, extending over a period of six years, have been taken at South Kensington, and a first examination of the negatives has led to several important conclusions (*Roy. Soc. Proc.* vol. lvii, p. 173). The lines of hydrogen were constantly bright in the period covered by the photographs, and other bright lines were also seen in all good photographs. Further, the lines of hydrogen are double in all the photographs taken with sufficient dispersion, and the distance between the components is constant within the limits of error in measurement. Other conclusions are that the bright lines of hydrogen are superposed on broad dark bands, and that there are also other ill-defined dark lines in various parts of the spectrum; these dark lines correspond very closely with the lines seen in the spectra of ζ Orionis and Bellatrix. "This at once contradicts Prof. Scheiner's recent statement that he does not believe it possible that dark lines can exist in the spectrum." Dark lines have also been observed and photographed by Keeler.

It will be seen that the spectrum presents numerous peculiarities, and an explanation of the physical condition of the star or stars which produce the different appearances is by no means simple.

THE IDENTITY OF DENNING'S AND BRORSSEN'S COMETS.—It was pointed out in the *Astronomische Nachrichten*, No. 3271, that the orbits of the comet 1894 I (Denning), and Brorsen's comet, intersect in heliocentric longitude 285°, and that early in 1881 the two objects must have been close to one another near the point of intersection (see *NATURE*, January 24, p. 302). The elements used for the comparison were, in the case of Denning's comet, due to M. Schulhof. This computer gives new elements for the comet, in *Astr. Nachr.* No. 3276, and expresses an opinion upon the suggested connection. He thinks that the elements compared, with the exception of inclination, certainly present some points of resemblance. More important, perhaps, is the fact that the point of intersection of the two orbits is nearly their point of nearest approach to the orbit of Jupiter.

Applying M. Tisserand's criterion for the connection between two orbits, the value 0.47 was found for Brorsen's comet, and 0.50 for Denning's. It is therefore concluded that the two comets formed at one time a single body, and that after their separation their orbits were more and more modified by Jupiter.

THE ANTITOXIC SERUM TREATMENT OF DIPHTHERIA.¹

II.

The Treatment.

ASSUMING now that the antitoxic serum is available, how is it to be used? It has been strongly recommended that it should be used not only as a curative or direct therapeutic agent, but that it should also be used as a prophylactic—that is, as a protective agent against possible infection, especially during those periods when diphtheria is rife. It is almost too soon to consider this prophylactic property of antitoxic serum, as for some time to come the energy of those engaged in the preparation and use of this serum must be directed towards obtaining a sufficient supply for the treatment of cases of developed diphtheria.

Results of this Method of Treatment.

It may be well to consider what have been the results obtained up to the present, and for this purpose the statistical method will probably carry most conviction, especially if it is possible to give full and accurate detail; and now that these statistics have been criticised not only by those who have used this treatment, but also by those who oppose it because it runs counter to their feelings and ideas, they are every day more and more trustworthy, much fuller, and more valuable.

It is first necessary to determine the average case mortality in diphtheria for some considerable period before the antitoxic treatment was introduced; then to see what has been the lowest case mortality during an equal and similar period for which we have any statistics; and lastly, to compare these with the case mortality of the period during which the antitoxic serum has been used.

In Table I. are given the mean annual death rates from diphtheria per million living in England and Wales and in London, in four periods of three years each.

TABLE I.

	1881-3	1884-6	1887-9	1890-2
England and Wales ...	144	166	173	192
London ...	213	227	315	377

Dr. Sykes gives the following statistics:—During the year 1892 there were 1962 deaths from diphtheria in London, whilst in 1893 there were 3265, or nearly twice as many deaths.

Now let us see what has been the case mortality. Statistics after correction give the following results. During 1893 there were 13,694 cases of diphtheria notified in London. The mortality amongst these cases was 3195 (*Lancet* statistics corrected), or 23.3 per cent.

Table II. gives further information, and enables us to see what is the diphtheria case mortality in large well-found hospitals.

TABLE II.—Metropolitan Asylums Board: Admissions and Case Mortality, Diphtheria, 1888-93.

Year.	No. of admissions.	No. of deaths.	Percentage of case mortality.
1888 ...	99	46	46.4
1889 ...	722	275	38.0
1890 ...	942	316	33.5
1891 ...	1312	397	30.2
1892 ...	2009	583	29.0
1893 ...	2848	865	30.3

Note.—Diphtheria cases have only been admitted into the Hospitals since October 23, 1888.

In Table III. are given statistics dealing with the diphtheria case mortality where the serum treatment has been used. Wherever possible, the case mortality over a considerable period is given in the last column of the table, for purposes of comparison.

¹ A lecture delivered at the Royal Institution, on Friday, February 8 by Dr. G. Sims Woodhead. (Continued from page 406.)

TABLE III.

		Number of cases.	Number of deaths.	Percentage of mortality.	Percentage of previous mortality.
GERMANY, AUSTRIA, HOLLAND :—					
Kossel (up to May 1894) ...	Berlin	233	54	23'0	34'7
Kossel (March 15-December 1, 1894) ...	"	117	13	11'1	
Bokai ...	Buda-Pesth	35	5	14'2	
Heubner ...	Berlin	96	37	38'5	
Katz ...	"	128	17	13'2	38'9
*Aronson ...	" &c.	255	31	12'1	32'5-41'7
Körte ...	"	121	40	33'1	53'8
Ranke ...	Munich	19	4	21'0	49'2
*Weibgen ...	Berlin	65	18	28'0	40'0
Börger ...	Greifswald	30	2	6'6	20
Kuntzen ...	Oscher-leben	25	3	12	
Hager ...	"	25	1	4	
Möller ...	Magdeburg	76		39'6	55'6
Sonnenburg ...	Berlin	107	22	20'6	27'6
*Bagnisky (quoted by Virchow) ...	"	303		13'2	47'8
*Hahn ...	"	205	49	24	40'0
Wiederhofer ...	Vienna	100	24	24	52'6
	Trieste	252	45	17'8	43'8
Schüler ...	"	32	none	0'0	
Strahlmann ...	"	100	"	0'0	
Rumpf ...	Hamburg	26		8'0	12'0
Blumenfeld ...	Austria	50	2	4'0	38'0
Heim ...	Vienna	27	6	22'2	52'5
Gnändinger ...	"	27	11	40'7	
Monti ...	"	25	1	4	
Unterholzner ...	"	31	8	25'8	66'6
Ganghofner ...	Prague	110	14	12'7	49
Other observers		39	4	10'2	
FRANCE, ITALY, BELGIUM, SWITZERLAND :—					
Roux, Martin, and Chaillou ...	Paris	448	109	24'5	51'7
Moizard ...	"	231	34	14'7	50'0 ¹
Lebreton ...	"	242	28	11'5	
Rabot ...	Lyons	47	16	34'0	50'0
Mya ...	Florence	17	2	11'7	
Massei ...	Naples	4	none	0'0	
Charon ...	Belgium	13	4	30'7	
Seitz ...	Constance	27	1	3'7	
AMERICA :—					
White ...	New York	32	8	25'0	42'7
Muehleek ...	Philadelphia	2	0		{ Two not treated died
Welch ...	Baltimore	5	1	20	
Catlin ...	"	1	0		
GREAT BRITAIN :—					
Cases reported in the <i>Lancet</i> and <i>British Medical Journal</i> ...		123	22	17	Average for London 23'3
Washbourn, Goodall, and Card ...		72	14	19'4	Average for Hospital 38'8

It is objected, however, that general statistics of this kind are of comparatively little value unless the age of the patient treated is given. In order to determine the foundation upon which this certainly very legitimate objection is based, I have

¹ There is probably some overlapping, especially in the Berlin figures. This fact must be taken into account in dealing with this table as a whole.

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taken four series of cases as reported, and have placed them side by side. The percentages of deaths at certain ages in the London Asylums Board hospitals before the serum treatment are given in Table IV., the percentages of deaths of four observers who have used the serum, in Tables V. and VI.

TABLE IV.—Showing the Mortality at Various Ages from Diphtheria admitted into the Metropolitan Asylums Board's Hospitals in the years 1888-93.

Ages.	Cases admitted.	Died.	Mortality per cent.
Under 1 ...	146	102	69'9
1 to 2 ...	447	291	65'1
2 to 3 ...	639	388	60'7
3 to 4 ...	826	416	50'4
4 to 5 ...	913	400	43'8
Totals under 5 ...	2971	1597	53'8
5 to 10 ...	2462	705	28'6
10 to 15 ...	885	93	10'5

TABLE V.
Showing Mortality from Diphtheria at various Ages.

	Kossel.			Wiederhofer.			Goodall.			Total.		
	Treated.	Died.	Per cent.	Treated.	Died.	Per cent.	Treated.	Died.	Per cent.	Treated.	Died.	Per cent.
Under 1 year ...	3	1	33'3	8	5	62'5	4	1	25'0	15	7	46'6
1-2 years ...	4	0	0'0	24	9	37'5	10	2	20'0	38	11	28'9
2-3 " ...	18	2	11'1	20	7	35'0	7	1	14'3	45	10	22'2
3-4 " ...	14	3	21'4	14	0	0'0	9	3	33'3	37	6	16'2
4-5 " ...	20	3	15'5	16	3	18'7	10	5	50'0	46	11	23'9
Total under 5 ...	59	9	15'2	82	24	29'2	40	12	30'0	181	45	24'3
5-10 years ...	45	3	6'6	15	0	0'0	22	2	9'1	82	5	6'0
10-15 " ...	13	1	7'7	3	0	0'0	10	0	0'0	26	1	3'8
Grand totals ...	117	13	11'1	100	24	24	72	14	19'4	289	51	17'6

¹ None of these were more than 13 years of age.

TABLE VI.
Baginsky (quoted by Virchow).

	Without serum treatment.			With serum treatment.		
	Treated.	Died.	Per cent.	Treated.	Died.	Per cent.
0-2 years ...	33	23	69'7	34	8	23'5
2-4 " ...	56	37	66'1	82	16	19'5
4-6 " ...	50	27	54'0	81	7	8'6
6-8 " ...	44	15	34'1	46	5	10'9
8-10 " ...	24	7	29'2	30	3	10'0
10-12 " ...	14	1	7'1	18	0	0'0
12-14 " ...	9	0	0'0	12	1	8'3
	230	110	47'8	303	40	13'2

It is very important, however, that the period of the disease at which the treatment is commenced should be taken into account, for, as already indicated, experience has taught that the later the stages of the disease at which this serum is injected, the stronger must be the dose given. It is necessary, therefore, to separate the cases in which the treatment is commenced at an early period from those in which it is commenced only when the poison has had time to disorganise the tissues, and to render them incapable of reacting to the antitoxic serum.

The following table (VII.), given by Kossel, brings out the great importance of this element in keeping down the case mortality. In the first column is given the day of the illness on which antitoxic serum was first injected:—

TABLE VII.

Day of illness.	Treated.	Died.	Percentage.
I. ...	14 ...	0 ...	0'0
II. ...	30 ...	1 ...	3'3
III. ...	29 ...	0 ...	0'0
IV. ...	9 ...	1 ...	11'1
V. ...	11 ...	2 ...	18'1
VI. ...	6 ...	3 ...	50'0
VII. ...	5 ...	2 ...	40'0
VIII. ...	6 ...	2 ...	33'3
IX. ...	1 ...	1 ...	100'0
Unknown ...	6 ...	1 ...	16'6
	117 ...	13 ...	11'1

For statistical purposes, too, only those cases which have been bacteriologically examined and found to be due to the action of Loeffler's diphtheria bacillus should be accepted as being cases of true diphtheria. As most of the cases in which the diphtheria bacilli are absent run a much milder course, and are much more amenable to general treatment, and as many of these have been included under diphtheria in the old statistics, such elimination will necessarily make the record tell rather against the antitoxic serum treatment than in its favour.

From a somewhat extended experience (although condensed into a very short period of time) I am satisfied that this question of the Loeffler bacillus is most important, and that every case in which the serum is used should be bacteriologically examined.

It has been said, however, and said very truly, that statistics may be made to prove anything, and I have heard it said that the observation of a few cases of diphtheria under the antitoxic treatment is worth all the statistics that could be brought together for convincing a man of the value of the antitoxic serum treatment.

A distinguished physician, who has had charge of diphtheria wards for some time, informs me that the patients he sees now wear an entirely different aspect from those he saw before the serum treatment was adopted. Instead of being struck by the stupor, the pain, the difficulty of breathing, and the other distressing symptoms that so frequently manifest themselves during the course of this treacherous disease, he observes children with patches of membrane in the throat sitting up and playing with their toys. There is little of that distress of breathing, very little of the anxious look, and the wards altogether present a much more pleasant and genial appearance than he has ever before noticed. The other day I received a short note from another colleague, who has been going over the German hospitals to study this question, in view of taking out with him to the colonies a supply of antitoxic serum; he also states that this difference in the appearance of the diphtheria wards has impressed him far more than any statistics he has yet come across.

The alleged ill-effects of the Use of the Serum.

It has been said that most unfavourable symptoms have followed the exhibition of this serum. There can be no doubt of the fact; but after a careful study of the cases reported, I am thoroughly convinced that a very large proportion of them, at any rate, are merely *post hoc*, and not *propter hoc*. There can be no doubt that a kind of nettle-rash makes its appearance during the course of treatment, and that this may be accompanied by pains in the joints. Both these conditions, however, are usually quite transient, and seldom give rise to permanent ill effects. Albuminuria has also been ascribed to this treatment; but any one who has had to deal with children not only suffering from diphtheria, but from any form of disease, and even from none at all, will bear witness that albuminuria in children is of comparatively frequent occurrence. It is not striking, therefore, that those who have hitherto paid little attention to this subject should, when they come to make a careful examination of children affected with diphtheria, find a considerable number of cases in which transient albuminuria is a prominent symptom. More than this, however, it has been my duty to examine a large number of cases in which diphtheria has proved fatal, and in these cases there were certain lesions in the kidney, so distinct and so

frequently present, that in describing them I used to note simply "diphtheritic condition," and then describe in detail only those features in which the appearances differed from the type that I had in my mind. This will indicate to you that alterations in the internal organs, especially in the kidneys, such as would lead to marked interference with the performance of their proper functions, were present, and had been noted long before the antitoxic serum method of treatment came into use. I may give an example of what, under certain circumstances, might have been used as a powerful argument against the use of antitoxic serum. In the *Deutsche Medizinische Wochenschrift* for December 20 of last year is reported a case of acute hæmorrhagic nephritis coming on after the use of Behring's curative serum. The patient recovered. But a similar case of acute hæmorrhagic nephritis in diphtheria, in which, however, the curative serum was not used, is reported in the same number of the same journal. The author of the second paper quotes some interesting statistics to show that albuminuria is of frequent occurrence in cases of diphtheria not treated with antitoxic serum. One observer found it in 131 out of 279 cases; another in 16 out of 53; another in 60 per cent. of all his cases; another in 227 out of 470. Suppression of urine has also been ascribed to the action of this agent; but here again, if a careful search be made of the records of diphtheria cases treated under the old method, it will be found that just as in scarlatina and acute specific infective diseases generally, but especially in those associated with rapidly supervening toxic symptoms, suppression of the urine is of common occurrence; and until we have statistics on these several points, which can be compared with those above mentioned, it will be impossible and unjust to ascribe conditions to the therapeutic agent which, so far as those best able to judge can see, are to be ascribed to the disease itself.

It has been held by some that the paralysis which is so common a sequel of diphtheria should disappear entirely under the use of what they are pleased to call a specific cure for the disease. It should be remembered that the antitoxic serum cannot make good any organic damage that has been caused by the action of the toxic products of the diphtheria bacillus. It may stop their action on the tissues, and it may stimulate the tissues to react against the poison, but to the tissues themselves must be left the process of repair; the *vis medicatrix nature* is alone responsible for the making good of damage already done. This damage may be done at a very early stage of the disease, and if the nerves or the muscles are attacked before the antitoxine is injected, then we must expect to find degenerations and evidence of these degenerations in the various forms of post-diphtheritic paralysis; but of this we may be sure, the sooner the poison is antagonised the less will be the risk of permanent damage to the tissues. It is for this reason, I believe, that the antitoxic serum treatment of diphtheria has been so much more successful than the antitoxic serum treatment of tetanus.

Conclusion.

The hope of success in diphtheria depends upon the early application of the remedy. One word of warning. It should not be accepted that this agent can reduce the cure of diphtheria to a mere process of injection. Everything must be done to improve the conditions under which the patients are treated, to maintain their strength, to give them fresh air, cleanly surroundings and good general hygienic conditions. It will be found withal that a certain number of deaths from rapid poisoning will take place, while a number of others will succumb in the later stages of the disease. This serum can no more act as a specific in every case than can quinine cure every case of malaria; but if properly used, we believe it will reduce the mortality in a very marked degree, and if at the same time those practical sanitary reforms and improvements for which our country is so justly renowned are carried out, we may expect that diphtheria as a scourge may gradually die out from our midst. As Dr. Seaton pointed out at Buda-Pesth, we have done more in this country to improve the conditions associated with most specific infective diseases than any other nation in the world. If, now, we can graft on to our system what is best in Behring's treatment, I am convinced that we shall soon have diphtheria statistics which will compare very favourably with any that have yet been presented. The antitoxic serum treatment is only one of our lines of defence against this disease; but so much progress has already been made along this line, that within a few years, or even months, we may fairly anticipate the announcement of still greater advances and successes.